of 300 or 400 times, and no polishing can remove or modify them. Sometimes 3000 of them may be counted in an inch, while in another part of the same specimen they become much coarser; and a corresponding appearance may be detected in the substances which have received the impression. The axis of extraordinary reflection is always perpendicular to the direction of these grooves. Dr. Brewster thinks that the general reflection by which the common image is formed, is the effect of the repulsive force of the whole surface, acting at such a distance, that its irregularities do not interfere with the equality of the angles of incidence and reflection; but that which has escaped this reflection is subjected to the influence of the grooves, the form of which, as he shows from the phenomena, must be curvilinear. The spectra do not resemble those which are produced by ordinary inflection, and which are observed in circumstances materially different. Dr. Brewster has in vain attempted to obtain coloured impressions from the Labrador spar, and from several of the metallic oxides: he finds that the crimson and green light of the mother-of-pearl are dependent on its thickness, like the colours which are seen in the common thin plates, but that they appear at much greater thicknesses.

The last peculiarity which the author has found in this interesting substance, is the manner of its polarizing light. In crystallized bodies, two portions of light are differently polarized with respect to the direction of the plane of incidence; but here the transmitted and reflected light are polarized in the same direction. The polarization is the most complete when the angle of incidence is about 60°, and when the thickness is about one fortieth of an inch; the transmitted light is in this case wholly polarized. If the plate is thicker, the transmitted light is wholly polarized at a smaller angle of incidence; and this polarization remains unaltered when the superficial reflection is destroyed by the contact of a substance of equal refractive density.

Dr. Brewster concludes with observing, that the subject is far from being exhausted; and that if the investigation could be carried on with the aid of analogous phenomena, we might confidently look forwards to some great change in the fundamental principles of physical optics.

An improved method of dividing Astronomical Circles and other Instruments. By Capt. Henry Kater. *Communicated by* Thomas Young, *M.D. For. Sec. R.S.* Read May 5, 1814. [*Phil. Trans.* 1814, *p.* 419.]

Although the author is most ready to admit the accuracy of Mr. Troughton's method of dividing, which was described in our Transactions for the year 1809, and by which the mural circle at Greenwich has been divided, it appeared to him that some improvement might be made in regard to simplicity and facility of execution.

The general principle of the method here described by Capt. Kater is, in fact, the same as that of the beam compass; but his apparatus,

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instead of having points like the beam compass, has two micrometer microscopes adjustable to different distances, as aliquot parts of an arc or line to be divided. For the purpose of marking on the surface of the instrument any assumed interval between the microscopes, certain thin pieces of small brass, carrying dots, are employed, with a clamp for fixing them to any part of the limb, and with proper screws for adjusting them to any precise position.

In addition to these, which are adapted for finding aliquot parts of the circle under division, the apparatus is provided with a cutting point of the usual construction, and a third microscope fixed always in the same position, for the purpose of observing a certain line first laid down as a permanent point of reference, and for watching the performance of the cutting-point, while it marks the successive intervals, determined by means of the two adjustable microscopes.

As a specimen of the method in which this apparatus is to be used, the author describes the series of divisions and subdivisions which he thinks most convenient in a circle of two feet diameter.

He first divides into five parts of 72° each.

At the same time that the fixed microscope is kept steadily over the original line of reference, two adjustable dots are placed, by estimation, at the distance of 72° from each other, and in such a position with reference to the cutting-frame as not to interfere with its motion. The two adjustable microscopes having next been placed so that their wires exactly correspond with these dots, the circle is made to revolve so that the second dot shall come under the first microscope when a third dot is to be placed under the second microscope; and in the same manner a fourth and a fifth dot in succession, till the fifth interval can be compared with the distance between the microscopes, when the first dot should be found to correspond exactly with the second microscope: if it be otherwise, the difference must be measured by the micrometer; and the distance between the two micrometers, originally assumed at 72°, must be corrected by one fifth part of the error so found, and must subsequently be ascertained to be correct, by a careful repetition of the same operation of the adjustable dots. When the fifth interval has thus been made accurately to correspond with that between the adjustable microscopes, the original point of reference is then to be returned to its position under the fixed microscope, and the divisions are to be marked in succession as the series of dots are made to appear under the wires of the adjustable microscopes, which are now known to be accurately 72° from each other.

The next step taken is to divide each of these intervals into three parts of 24 each, and again trisect into parts of 8°. These, by repeated bisection, are reduced to half degrees; and these again, by trisection, are divided into spaces of 10′ each.

In the performance of the latter steps of this subdivision, the author suggests the periods when it may be found convenient to bisect some larger odd number of divisions, instead of taking a single one for bisection, on account of the interference of the microscopes with each other; and he takes care to mention such other precautions as may not immediately occur to artists in the employment of a new apparatus, and to delineate accurately all those parts which might not be thoroughly understood by a mere verbal description.

Results of some recent Experiments on the Properties impressed upon Light by the Action of Glass raised to different Temperatures, and cooled under different Circumstances. By David Brewster, *LL.D. F.R.S. Edin. and F.A.S.Ed. in a Letter to the Right Hon. Sir* Joseph Banks, *Bart. K.B. P.R.S.* Read May 19, 1814. [*Phil. Trans.* 1814, *p.* 436.]

The author, being engaged in making a variety of experiments on resinous and other bodies that could be fused between plates of glass, remarked a partial depolarization while the subject of examination was hot, but which diminished on cooling, and consequently could not be ascribed to incipient crystallization. He therefore tried a plate of glass alone; and having previously raised its temperature almost to a red heat, he found that a ray of polarized light became completely depolarized by its passage through it: and he further thence infers, that glass brought to a certain temperature forms two images, and polarizes them like all doubly refracting crystals, only that the two images are, in fact, coincident, instead of being separated.

Since in the formation of the glass-tears, called Prince Rupert's drops, which are made by dropping melted glass into cold water, it is probable that in consequence of the sudden consolidation at the surface, the interior part is prevented from contracting, and consequently retains, in some measure, that relative distance of its particles which obtained in the fluid state, the author conceived these drops to be a fit subject for an interesting experiment; and having procured several such drops, made of white flint-glass, he cut and polished one of them by two planes at right angles to the axis, and a second by two planes parallel to its axis and to each other. When polarized light was transmitted through a drop in either of these directions, it was found to be depolarized; but there was not any position in which the transmitted ray would retain its polarization, as is found in corresponding experiments with crystallized substances.

Consideration of various Points of Analysis. By John F. W. Herschel, *Esq. F.R.S.* Read May 19, 1814. [*Phil. Trans.* 1814, *p.* 440.]

This paper is divided into four sections, the first of which treats of the calculus of generative functions, and relates solely to characteristic notation, and to the method of separating the symbols of operation from those of quantity. The second relates to logarithmic transcendants, with a variety of remarkable results deduced from them. The third relates to functional equations. The fourth to differential equations of the first degree. But the whole of this paper was of a nature not adapted for public reading.